science which plays such an important part in our daily lives should be so little taught that in all our hundreds of colleges there is only one that has a chair of climatology. We are an agricultural nation and the variations in the weather are the chief cause of variations in crops—and yet the farmers' children are taught almost nothing about the science of *weather and climate and their relations to agriculture.* * * *

The exquisitely appointed Russian observatory at Pavlovsk is located in a corner of a park belonging to the royal family. There the late Professor Wild was accustomed to spend his summers and while he no doubt enjoyed its beauties, yet he carried on experiments and observations which made this observatory the most celebrated of its kind in the world. The present writer will never forget the summer weeks that he spent in that fairyland of science.

Or take another case, that of the Potsdam Observatory. The German Government is not given to wasting money and yet it supports a most extensive observatory in the beautiful Potsdam Park; an observatory which performs in part the same functions as will the new Weather Bureau observatory.

A third kind of observatory has also been established in Europe, viz, well equipped observatories at high elevations on mountain peaks. Such are the observatories of Ben Nevis, Scotland, Puy de Dome and Pic du Midi in France, and the Sonnblick in the Tyrol. We had it is true our own Mount Washington and Pikes Peak government observatories, but they were only counterparts of the ordinary Signal Service observing stations and had none of the completeness of the best European mountain observatories. *It remained for Mr. A. Lawrence Rotch, of Boston,* to give us the first well-equipped mountain observatory in this country, and although he located it on the relatively low-lying crest of the great Blue Hill, yet it is perfect in its appointments, and sets us an example by which to build our future mountain observatories. The work of this private observatory is among the best of its kind in the world.

However pleasant a few days sojourn on a mountain top may be in midsummer, no one will say that it remains agreeable for any lengthy stay, and a winter's residence is only made bearable by a sense of obligation or duty. Some of the most heroic scientific work ever undertaken has been at these mountain meteorological stations, as the records of Ben Nevis, the Sonnblick, and Mount Washington amply show. And the new Mount Weather Observatory will undoubtedly furnish an additional field for heroic winter scientific research, although the climate is not so severe as on some higher mountains on which observatories have been located.

That observatory is in a manner a combination of these two kinds of observatories, in both of which our Government service has hitherto been lacking; it fills the place of two observatories by accomplishing the work of both. It has then been an economy to build this combination observatory. * * *

At the present time the Weather Bureau has no adequate training school for its observers, and its new observatory will fill this need to the extent of its limited capacity. * * *

There are many college instructors and other scientific men who desire to carry on some special work, bearing on meteorology, at a well equipped observatory. Such men are made welcome at the great European observatories, and they have carried on valuable observations and experiments. The Weather Bureau is now for the first time able to extend such courtesies to American and foreign scientists. * * *

There is a great class of refined observations which can only be carried on at a distance from the disturbing influence of a city. Such observations can now be undertaken at this new observatory. In the study of the phenomena connected with American storms it has an unsurpassed location. It lies as nearly as possible within the track of the three great classes of storms that sweep over the eastern United States; the cyclones from the Mississippi Valley, those from the west Gulf (Texas and Mexico), and those from the West Indies which pass along our eastern coast. We may now expect that much light will be thrown upon the relations of these storms. * * *

In fine, the building of this new weather observatory must be regarded as the most important step taken by our Government in late years for the betterment of the Weather Bureau service.

MOUNTAIN STATIONS AND THEIR IMPORTANCE.

A letter of March 23, 1905, from Prof. Alexander G. McAdie incloses one from Prof. J. E. Church, jr., of the Nevada State University, Reno, Nev., relative to observations on Mount Whitney, Cal., and Mount Rose, Nev., with the request that the Editor give his opinion as to the importance of mountain stations.

The letter of Professor Church reads as follows:

RENO, NEV., *March 18, 1905.*

Prof. ALEXANDER MCADIE,
San Francisco, Cal.

DEAR SIR: Mr. Marsh and I spent eight days on Mount Whitney and climbed to the altitude of 13,250 feet where we could look down on Langley's Lake. At this point the ledge was piled full of drifting snow with a treacherous crust beneath, I now believe that we could have succeeded in crossing this, although the risk would have been great.

The ascent to 13,500 could be made at any season of the year, I believe, especially if two or three cabins were constructed along the trail for refuge in case of storm. Access could be had to the summit also during most of the year, Mr. Marsh believes, if a narrow trail for man were cut higher up the pinnacles where the drift snow could not lodge in sufficient quantity to prevent the observer from keeping the trail open. The expense would not exceed $150.

The weather was mild, though snow clouds hung over the mountains. The temperature did not fall below 10° F. The wind blew almost constantly from the east, from the subtropical Owen's Valley, and seemed to have an appreciable affect upon the temperature of the mountain, for Lone Pine Lake (9800 feet) and Mirror Lake at timber line (10,450 feet) were only partially frozen over, while the lakes west of Mount Whitney at apparently similar altitudes were frozen completely over and covered with snow. The snow also was mealy and unstable, with little hardness anywhere, such as I have always found on Mount Rose above the altitude of 8500 feet.

As regards the difficulty of the ascent in winter, I should consider Mount Shasta as not only far easier, but also entirely safe save for the possible fusillade of rocks below the Red Cliffs. There is no horse trail up Mount Shasta, however, above the altitude of 9000 feet.

I wish I were free to volunteer to take observations on Mount Whitney for you for a year.

If you are willing, I will take the readings of a maximum and minimum thermometer on Mount Rose (10,860 feet) north of Lake Tahoe, nearly every month during the coming twelve months, if you will send me the instruments. The results might have some value. Mount Rose is the highest point east of the summits of the Sierras and north of Lake Tahoe. The wind is usually very high there, but Lake Tahoe may have an influence on the temperature. If you are favorable, I could place the thermometers on Mount Rose at once. The temperature early in February at 6500 feet altitude on this mountain fell considerably below zero to judge from the frost crystals in my sleeping bag and frosted feet, and from the temperature of —15° and —25° F. at Truckee and Floriston the same night.

Our party had the honor of naming the peak directly south of Lone Pine Pass, Mount McAdie, to commemorate your services in advancing the science of climatology. Its altitude is at least 13,500 feet. If, as Mr. Marsh declares, this peak has not previously been named, we beg that you allow this name to stand.

The importance of mountain stations has been felt to an increasing degree ever since Perrier, by the advice of Pascal and Descartes, ascended the Puy de Dome, and demonstrated beyond all cavil that barometric pressure diminishes with altitude in proportion to the weight of the atmosphere left below as the observer ascends. It thus became evident that the vacuous space in the upper part of the barometer tube was not due to the fact that nature abhors a vacuum, but to the actual pressure exerted upon the mercury in the cistern by the surrounding gas. The so-called barometric constant now used in hypsometry was approximately determined about 1800–1810 by a series of observations made by Ramond at the summit of the Pic du Midi de Bigorre, France, and by Dangos at Tarbes near the base of that mountain. But permanent mountain stations began at a much later period, and for a long time the most famous of these were our own stations on Mount Washington and Pikes Peak. As the Editor had something to do with the establishment and maintenance of these stations, he may be allowed to say that their records still rank among the most important that we have. They gave us, day by day, positive knowledge in place of hypotheses as to what was going on in the atmosphere far above the conditions depicted on our daily weather maps. It was not necessary to reduce such stations to sea level, for we wanted the records as they were for these upper levels. If we could only have had enough stations to make maps of the conditions above us, we should undoubtedly have advanced far ahead of where we are now in our knowledge of the atmosphere and in our ability to predict the weather. In future years numerous kite and balloon stations will undoubtedly enable us to realize this great desideratum.

Now that very high mountain stations exist all over the world, we may turn to them and the studies that have been made of their records, especially as quoted in Hann's Lehrbuch

der Meteorologie. Among the high stations Mexico has eight that really belong to high plateau stations, United States had three high plateau stations and two mountain stations, South America has two high plateau stations and three very high mountain stations. In Austria-Hungary we find three high mountain stations, in Great Britain one, in France four, in Germany four, Russia one, Portugal one, Switzerland five. India has two plateau and one mountain station. South Africa has three mountain stations; Australia, New Zealand, and Madagascar have each one.

Most of these are simple observing stations, eight or ten of them are furnished with continuous self-recording apparatus, and a few of them are so elaborately equipped as to be more properly designated observatories of the first class. At most of these stations the diurnal periodicities of the temperature, wind, and cloudiness have been carefully determined, and the comparison with the same periodicities at lower stations has revealed differences that seem to follow regular laws, which, if they continue to hold good for still higher regions and for other portions of the globe, may make us feel that we begin to know something about the ocean of air above us. But have we a right to infer that what holds good for a mile above sea level will also obtain for twenty or fifty miles farther up? That is the problem that is now being solved by the use of kites and balloons. The sounding balloon gives us six items with regard to the atmosphere up to ten or twelve miles, namely, the temperature, moisture, insolation, radiation, direction, and velocity of movement of the air. It could tell us about the pressure at those altitudes if we had any method of measuring the altitude trigonometrically, but thus far this has rarely been possible and the self-recording barometer carried by the sounding balloon is only used as a basis for determining the altitudes. The items given by the sounding balloon are very meager because they only hold good for a few hours on special days, but they are exceedingly welcome as supplementary to the continuous records of mountain stations.

Although thousands of observers have been at work for a hundred years gathering meteorological data yet much of this work has had an amateurish character and only a small portion of it lends itself to the needs of modern investigation. We have now a fairly satisfactory series of maps giving monthly and annual averages of pressure, temperature, winds, and rainfall for the surface of the land and the ocean, but we know less about the upper air than we do about the ocean deeps. So far as we can now see, our knowledge of the conditions and motions of the atmosphere in the midst of the clouds a few miles above our heads (where our storms form, develop, and die) must always depend upon the results of difficult mathematical investigations, checked as to their accuracy by an occasional balloon ascension and the steady records of a few mountain observatories. The conviction of the truth of this general statement has led the leading meteorologists of the world to unite in international work for the maintenance of mountain stations, kite work, balloon work, and for the publication of a series of memoirs embodying the results of their study "on the physics of the free atmosphere or the scientific investigation of the higher strata of air." The last number of the publications of the International Committee for Scientific Aeronautics gives the results of simultaneous observations on April 14, 1904, as obtained by seven sounding balloons, five ordinary balloons, five kite stations, twenty-five mountain or hill stations, and thirty-three stations for the observation of clouds. All of these relate to the atmosphere over Europe, excepting the one record from Blue Hill, Mass. There could not be any more eloquent testimony as to the value of research in the upper air and the thoughtful reader will at once see that up to the present time mountain observatories have formed the fundamental basis for all this work, while kites and balloons have been but auxiliaries. These latter are sent up simultaneously once a month, while the mountain work goes on continuously night and day. All this is research work so-called, looking to the improvement of our knowledge of the atmosphere and therefore of our weather predictions, which latter may for a long time depend wholly upon weather maps representing the conditions near sea level. We must wish success to every movement toward the establishment of mountain stations in the United States. They are doubtless expensive and life therein may be lonesome, but enthusiastic observers and students will always be found to do work worthy of the support of the patrons of science. The mountain peaks of the Coast Range, the Sierras, Rockies, and Appalachians should be crowned with a series of sentinel towers where watch may be kept of every change foreboding storm, or rain, or drought. The astronomers have their hundreds of costly observatories for the study of the sun and the stars, but it is still more important that meteorologists should be furnished with the observatories that are so greatly needed by them.

AN ABSURD EXPLANATION AS TO INDIAN SUMMER.

A writer who signs himself L. M. McC. published in the Chicago Evening Post of October 4, the following paragraph:

> At Indian summer the whirling planet sails into the broad aerial gulf stream, a vapor plane that stretches through space. Its dust fills the atmosphere, its moisture and peculiar qualities for light reflection bring us the hazy days, the mellow sunlight, and that mysterious influence of indolence.

Those who have studied astronomy and physics in the ordinary high school scarcely need to be told that these ideas are purely fanciful and entirely contrary to what is possible in nature. We have not yet been able to prove that meteors or shooting stars or meteoric dusts have anything more than a perfectly inappreciable influence on our atmosphere; they must have some little influence, but they do not produce the Indian summer haze. There is no broad aerial gulf stream for our whirling planet to sail into. There is no vapor plane stretching through space. The dust and moisture that fill our atmosphere rise up from the surface of the earth and produce the haze that we see until clouds and rain wash the air clean again.

THE ALTITUDE OF MOUNT WHITNEY, CAL.

Communicated by H. C. Rizer, Acting Director, U. S. Geological Survey, September 1, 1905.

The elevation of Mount Whitney, Cal., was determined by the U. S. Geological Survey as being 14,502 feet in August, 1905, by a check line of spirit levels run by Mr. R. A. Farmer, topographer, under the direction of Mr. E. M. Douglass, geographer, from Mount Whitney station on the Southern Pacific Railroad, situated a few miles north of Owens Lake, to the summit of the peak. The initial elevation of Mount Whitney station was accepted as 3691 feet, as derived from a line of precise levels run earlier in the season from Mojave, Cal. The bench mark at Mojave, in turn, is on a line of precise levels based upon a tidal bench mark at San Pedro Harbor near Los Angeles, and checked by connecting with a tidal bench mark of the Coast and Geodetic Survey at Benicia Arsenal on San Pablo Bay, a few miles north of San Francisco. The distance from Mount Whitney station to the summit of Mount Whitney along the line leveled is 23 miles, with a rise of 10,811 feet.

Other determinations of Mount Whitney make its elevation as follows:[1]

Authority.	Method.	Feet.
Professor Whitney,	by barometer	14,898
Lieutenant Wheeler,	by barometer and vertical angles	14,470
Professor Hallock, of Columbia University, New York,	by boiling point	14,525
Professor Langley,	by barometer	14,522

[1] A discussion of the previous determinations of the altitude of Mount Whitney will be found in the MONTHLY WEATHER REVIEW for November, 1903, pages 524, 527, 533. Professor McAdie's computation of his own observations gave 14,515 feet.—ED.